

Cysticercus Tenuicollis: Occurrence at Hashim Nur's Meat Export Abattoir, Debre - Zeit, Ethiopia

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Abstract: This study was conducted from December 2010 to March 2011 in Hashim's Livestock and Meat Export Abattoir at Debre Zeit, Ethiopia. The aims of this study were to determine the prevalence and distribution of *Cysticercus tenuicollis* (*C. tenicollis*) and to estimate the economic loss attributed to the condemned organs from sheep and goats slaughtered. Ante-mortem and post-mortem inspection were conducted. Ante-mortem inspection was conducted in the lairage and abnormalities encountered were recorded, followed by post-mortem examination through their identification number to detect gross abnormalities. During the study, a total 415 goats and 395 sheep visceral organs were inspected. *C. tenuicollis* was found in 164 goats (39.5%) and 143 sheep (36.2%), respectively. Adult goats (47.2%) and sheep (38%) were more infected than kids (32.9%) and lambs (34.6%)- Goats (58.5%) and sheep (62.2%) from midland areas were more infected than goats (41.4%) and sheep (37.8%) from lowland areas ($P<0.05$). *C.tenuicollis* had a tendency to be located more in the omentum than other organs and this difference between infections rate of omentum and other organs was significantly associated ($p<0.05$). The liver lesions are unsightly and affect the texture of the tissue, making it unsuitable for human consumption and as a result extensive financial loss of the country associated with condemnation. So as to reduce these losses, further studies should be done in different abattoirs of the country and introduce preventive measures to reduce unnecessary financial losses.

Key words: *Cysticercus tenuicollis* • Export Abattoir • Small Ruminants • Occurrence • Ethiopia

INTRODUCTION

Ethiopia has the largest livestock population in Africa, estimated at 38 million cattle, 23 million sheep and 18 million goats, which are raised almost entirely by smallholder farmers throughout the country [1]. Small ruminants (sheep and goats) are particularly important resources of the country as they provide more than 30% of local meat consumption and generate cash income from export of meat, live animals and skins [2]. However, a significant amount of organs and carcasses are condemned in slaughtered sheep and goat due to various diseases and pathological abnormalities and each year more than 900 million USD loss are estimated annually [3].

C. tenuicollis is among those diseases that results organ condemnation from slaughtered house.

C. tenuicollis is a larva of *Taenia hydatigena* (*T. hydatigena*) which is the most important parasite of sheep and goats. After the ingestion of egg the oncospheres enter the blood stream via the intestinal wall. It is thus carried to the liver where it bores its way through the liver substance. After 14 days it leaves the liver and enters the abdominal cavity where it develops to a large bladder worm, known as *C. tenuicollis*. If a sheep or goat swallows a whole tapeworm segment, which may contain 100,000 eggs, death may occur due to massive numbers of developing metacestodes known as Cysticerci [4]. *C. tenuicollis*, a metacestode of

T. hydatigena, invades the liver and abdominal cavity of the intermediate hosts like sheep and goats causing considerable tissue damage during larval migration. Fibrous scars resulting from the migration of the larvae lead to condemnation of the viscera and disposal of other offal's to which the mature bladder worms attached and if they fail they degenerate and become calcified.

Various investigations have been conducted to determine the prevalence and economic importance of organs condemned in Ethiopia [5]. According to Woinshet and Girma [6] the prevalence of *C. tenuicollis*, in visceral organs of slaughtered sheep and goat at Addis Ababa abattoir was 40.0% and 46.6% in sheep and goat respectively. Furthermore, many researchers indicate that, there is variation in the occurrence of *C. tenuicollis* in different areas of Ethiopia. However, most of the surveys paid attention to organ condemnation due to parasites in shoats. Hence, there are practically no dependable and precise information with regard to organ condemnation of small ruminants especially on liver due to parasitic cases like *C. tenuicollis*. In view of this, proper evaluation of economic loss due to liver condemnation in sheep and goats at abattoir is needed. This is of great relevance where economic realities often determine the type and scope of control. Hence, studying the prevalence and the economic loss due to the cyst is found to be an important thing for the improvement of the export earnings of the country. Therefore, the objectives of this paper were to determine the prevalence and distribution of *C. tenuicollis* in sheep and goat slaughtered at Hashim Nur's livestock and meat export abattoir and to estimate the direct and indirect economic loss attributed to the condemned organs.

MATERIALS AND METHODS

Study Area: The study was conducted at Hashim Nur's Livestock and meat export abattoir, in Debre Zeit town which is located at 90 N and 40 E. Its altitude is about 1880 m above sea level at 47 km South East of Addis Ababa. In the town, there are 160,697 cattle, 22,181 sheep, 37,510 goat, 5660 horse, 38,726 donkey, 268 mule and 191,380 poultry. It has annual rain fall of 1151.6 mm of which 84% falls during the long rainy season that extends from June to September and the reaming during the short rainy season that extends from March to May. The mean annual minimum and maximum temperatures are 12.30C and 27.70C, respectively and the mean relative humidity is 61.3% [7].

Study Population: The study population constituted of local breeds of sheep and goats coming from lowland and midland areas of the country and slaughtered at Hashim export abattoir, found in Debre Zeit. All slaughtered animals, were males. The average annual slaughter in this abattoir is about 30,000 sheep and 100,000 goats. Majority of the slaughter animals come from places such as: Harare, Arsi, Bale, Borana, Afar, Matahara, Awash, Arbaminch and Jenka areas which represent the lowland and midland regions of the country. In this study, small ruminants were categorized into two age groups, young and adult, two agro-ecological zones, midland and lowland and two species, sheep and goats. Sheep and goats with the first pair of permanent incisor teeth were considered as young and those with two and more pair of permanent incisors were regarded as adults [8, 9].

Sampling Method and Sample Size Determination:

The study was selected by systematic random sampling techniques. The sample size determined using the formula given by Thrusfield [10]. 688 small ruminants were examined but to increase precision, the number of examine animals were reached to 810.

Ante-Mortem Inspection: During ante-mortem examination underweight animals were detained less than 14 kg and 12 kg for sheep and goat respectively in Lairage. Animals were clinically examined for any sign of illness while standing and moving according to Urquhart *et al.* [11]. and following the judgments passed by FAO [12]. Animal were examined after evisceration serially numbered different paper tickets with different plastic tickets were placed on the liver.

Post-Mortem Inspection: During post mortem inspection the livers were thoroughly inspected by visualization, palpation and systemic incisions for the presence of parasites and other abnormalities. Cyst characterization (fertility and viability): the cyst collected was transported to the parasitology laboratory at the Faculty of Veterinary Medicine for confirmation and viability study on the cysts. To determine the viability, the cysts were incubated at 37oc in 40% sheep bile solution diluted in normal saline for 2 hours [13]. Cysts were considered viable if the head evaginated within 2 hours, then the identification of the cysts was done based on the morphological parameters set for the metacestodes. *C. tenuicollis* was differentiated from *C. ovis* on the basis of its relatively larger size, less

number of hooks, the position of the head and neck in relation to caudal bladder and also the location of the cyst in the body of the host [11].

Data Management and Statistical Analysis: The species, age, origin, body condition and visceral organs were collected. The raw data generated during post mortem inspection was entered into a Microsoft Excel spread sheet and the statistical analysis was performed using a Stata Version 8.2 Technologies. Descriptive statistics were used to determine the prevalence. The variation between infection rates of specific organs, age, species and origin of animals were evaluated by Pearson's chi-square test and P values of less than 0.05 were regarded as significant.

RESULTS

Out of 395 sheep and 415 goats examined, 143 (36.2%) and 164 (39.5%) were infected with *C. tenuicollis* cysts, (Table 1).

The distribution of cysts in the organs of infected sheep and goats is summarized and presented in. Among 810 livers examined in the export abattoir during the study period significance proportions (34.57%) were condemned due to *C. tenuicollis* infection (Table 2).

Organ Distribution of Cysts in Infected Sheep and Goats: When the data on distribution of cysts in the organs/viscera of infected animals in analysis and summarized in majority of the animals harboring *C. tenuicollis* the cyst had a tendency to be located more in the omentum and mesentery and peritoneum than in the liver. Only few small cysts were observed attached to the surface of the liver. Chi-square analysis of the result showed that there is significant difference in cysts burden between the liver and omentum ($P < 0.05$). The highest cyst burden was encountered in omentum and mesentery and lower percentage were found in other organs (Tables 3 and 4).

Table 1: Prevalence of *C. tenuicollis* with respect to the altitude of their origin.

Species	No examined	Positive (%)	Origin	Positive (%)	χ^2 -value	p-value
Goats	415	164 (39.5)	Midland	96 (58.5)	5.96	0.0147
			Lowland	68 (41.4)		
Sheep	395	143 (36.2)	Midland	89 (62.2)	10.46	0.0012
			Lowland	54 (37.8)		

Overall prevalence: χ^2 (1) = 0.95; P = 0.3309 (insignificant difference between species; $P > 0.05$)

Table 2: Total condemned liver due to *C. tenuicollis*.

Species	No of examined Liver	Total infected Liver	Total Liver condemned (%)	χ^2	p-value
Sheep	395	79	32(40.50)	0.99	0.3188
Goats	415	135	42(31.11)		
Total	810	214	74 (34.57)		

Table 3: Total cyst count in each organ slaughtered.

Species	Age	No examined	No infected	Total Cyst count in each Organ			χ^2	p-value
				Liver	Omentem and Mesentery	Peritoneum		
Sheep	Young	211	73	82 (45.6)	148 (47.8)	63 (44.1)	8.22	0.0042
	Adult	184	70	98 (54.4)	172 (53.0)	80 (55.9)		
Total		395	143	180 (24.4)	320 (42.7)	143 (19.4)		
Goats	Young	222	73	106 (44.2)	182 (44.3)	95 (44.4)	8.79	0.0030
	Adult	193	91	134 (55.8)	229 (55.7)	119 (55.6)		
Total		415	164	240 (27.7)	411 (47.5)	214 (24.7)		

Table 4: Over all infected organs among the totally examined sheep and goats

Organ	Infected organs	Non infected organs	Total	χ^2	p-value
Liver	214	596	810	8.61	0.003
Peritoneum	214	596	810		
Omentem and Mesentery	268	542	810		

DISCUSSION

An important function of meat inspection is to assist in monitoring diseases in the national herd and flock by providing feedback information to the veterinary service to control or eradicate diseases and to produce whole some products and to protect the public from zoonotic hazards [14]. Diseased animals that show signs of abnormality during ante-mortem inspection should not be allowed to enter the abattoir for slaughter [15]. All animals that undergo post-mortem examination were those which passed ante-mortem inspection. Both ante-mortem and postmortem examinations were done by veterinarians working for MoARD in export abattoir. The organs and carcasses passed for consumption in the export abattoirs are marketed in Saudi Arabia, United Arab Emirates and Yemen when requirements are fulfilled. The condemned organs having poor aesthetic value and pathologically unfit for human consumption are incinerated in the abattoir so as to break the transmission cycle of the various diseases.

During the study, from the total shoats slaughtered, parasite like *C. tenuicollis* was found to be the major causes that rendered liver rejection from international market. The spreading of infection is an indication of environmental contamination with the eggs of the adult dog tapeworms. *C. tenuicollis* is the most important and widely prevalent of the four metacestodes recording in small ruminants slaughtered in the study abattoir. Up to 37.9% of the slaughtered sheep and goats were found to be infected with the *C. tenuicollis*. The prevalence of *C. tenuicollis* by species was slightly higher in goats (39.5%) as compared to sheep (36.2%). However, this difference was not found statistically significant. Similar results were reported in goats in Nigeria [16]. The results of this study are higher than that reported by other workers [17]. The relative prevalence of *C. tenuicollis* recorded in the study could be due to the variations in temperature, environmental condition, the degree of pasture contamination and the way of rising and grazing of these animals which may favour the transmission cycle between ruminants and dogs. The age of the animals could also be another factor in these variations. The prevalence of *C. tenuicollis* found in sheep in this study (36.2%) is lower than that reported by Tekleye *et al.* [18], Pathak and Gaur [17]. However, the findings of this study in sheep are higher than other reports by Dada and Belino, [16]. The prevalence by the age revealed that higher infection rates was recorded in animals with two and more pair of permanent incisors teeth (38% in sheep and 47.2% in goats) followed by the first pair of

permanent incisor teeth (34.6% in sheep and 32.9% in goats), the lower prevalence was recorded in younger animals without permanent incisor teeth. These differences in prevalence rates between the age groups are statistically significant ($p < 0.05$).

According to Torgerson *et al.* [19], under condition of high infestation with *C. tenuicollis*, most sheep develop protective immunity early in life, whereas goats develop protective immunity more slowly. This considerable degree of immunity against *C. tenuicollis* in sheep may be the reason for low prevalence of the parasite in sheep. The infection rate of *C. tenuicollis* in the liver of adult sheep and goats were higher than that of the young sheep. The difference in infection rates between young and adult may be due to the fact that the adult animals (sheep and goats) lived longer and picked large number of eggs during grazing as compared to the young ones which only lived for a shorter period of time.

The epidemiology of *C. tenuicollis* was not well established in sheep and goats; hence, it may be difficult to explain why significantly more livers were condemned in goats (25.61%) than in sheep (22.04%) [20]. The difference in prevalence recorded in my study in the different agro-ecological zones may be attributed to differences in temperature and humidity [21]. The greater prevalence of *C. tenuicollis* in midland than in lowland areas may be due to the absence of vegetation in lowland areas. This is agreement with the findings of [6].

Adults were more heavily infected than young animals. This is in agreement with the findings of Woinshet and Girma [6] who found lower infection rates in lambs. The higher rate of infection in adult animals may be attributed to age itself. Adult animals might have picked more eggs of *T. hydatigena* during their life. Our finding, however, does not support the reports of Zahang and McManus [22] who stated that cestode parasites produce significant quantities of antigens in adult animals, which protect small ruminants from infection.

CONCLUSIONS

The cysts in small ruminants had a tendency to be located more percentages in the omentum than other organs. According to the result of this study *C. tenuicollis* is the most and major causes for respective organs of shoats to be rendered from international and local market and this results in extensive financial loss of the country. So as to reduce these losses the following recommendations are worth mentioning: Immediate, safe and controlled elimination of all condemned abattoir materials and the contaminated offal and heads as dog's

feed should be prohibited by law. Regular de-worming of dogs and elimination of stray dogs should be practiced and training of abattoir workers on procedures and cares during flaying and evisceration should be done. Different workshops should be prepared to enhance the awareness of the animal attendants, farmers, customers, abattoir workers and butchers pertaining proper disposal of condemned offals and carcasses. Further studies should be carried out in small ruminants that are going to be slaughtered in different abattoirs of the country and introduce preventive measures to reduce unnecessary financial losses due to *C. tenuicollis* encountered in the industry.

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